Docket No.: M4065.0210/P210
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Dan Gealy, et al.

Examiner: Hoa B. Trinh

Application No.: 09/588,008

Art Unit: 2814

Filed: June 6, 2000

For: A CAPACITOR FOR A SEMICONDUCTOR DEVICE (AS AMENDED)

AMENDMENT IN RESPONSE TO FINAL OFFICE ACTION

UNDER (37 C.F.R. § 1.116)

Commissioner for Patents
MS: Amendment
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This paper is in response to the Office Action dated August 25, 2004. Please amend the above-identified U.S. patent application as follows:

An **Amendment to the Specification** begins on page 2 of this paper.

Status of the Claims begins on page 3 of this paper.

Remarks begin on page 9 of this paper.

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AMENDMENT TRANSMITTAL LETTER

Docket No. M4065.0210/P210

Application No.	Filing Date	Examiner	Art Unit
09/588,008-Conf. #9015	June 6, 2000	H. B. Trinh	2814

Applicant(s): Sam Yang, et al.

Invention: A CAPACITOR FOR A SEMICONDUCTOR DEVICE (AS AMENDED)

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	Claims Remaining After Amendment	Highest Number Previously Paid	Number Extra Claims Present	Rate	
Total Claims	32	- 96 =		x	0.00
Independent Claims	2	- 5 =		x	0.00
Multiple Dependent Claims (check if applicable) ☐					
Other fee (please specify):					
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT:					0.00

[x] Large Entity [ ] Small Entity

[x] No additional fee is required for this amendment.

[ ] Please charge Deposit Account No. _____ in the amount of $ _____. A duplicate copy of this sheet is enclosed.

[ ] A check in the amount of $ _____ to cover the filing fee is enclosed.

[ ] Payment by credit card. Form PTO-2038 is attached.

[x] The Director is hereby authorized to charge and credit Deposit Account No. 04-1073 as described below. A duplicate copy of this sheet is enclosed.

[x] Credit any overpayment.

[x] Charge any additional filing or application processing fees required under 37 CFR 1.16 and 1.17.

Dated: November 18, 2004

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STATUS OF THE CLAIMS

This listing of claims replaces all prior listing of claims for the present application.

1. (Previously presented) A capacitor for a semiconductor device, said capacitor comprising:

a bottom conducting layer;

a dielectric layer formed over said bottom conducting layer; and

at least one top conducting layer formed over said dielectric layer, wherein at least an uppermost portion of the top conducting layer is an oxidized gas annealed layer.

2. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a material selected from the noble metal group.

3. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a metal.

4. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a metal alloy.

5. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a conducting metal oxide.

6. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a metal nitride.

7. (Original) The capacitor of claim 1, wherein said bottom conducting layer is formed of a material selected from the group consisting of: Platinum (Pt), Platinum Rhodium (PtRh), Platinum Iridium (PtIr), Ruthenium, Ruthenium Oxide (RuO_2), Rhodium Oxide (RhO_2). Chromium Oxide (CrO_2), Molybdenum Oxide (MoO_2), Rhemium Oxide (ReO_3), Iridium Oxide (IrO_2), Titanium Oxides (TiO_1 or TiO_2), Vanadium Oxides (VO_1 or VO_2), Niobium Oxides (NbO_1 or NbO_2), and Tungsten Nitride (WNx, WN, or W2N).

8. (Original) The capacitor of claim 7, wherein said bottom conducting layer is formed of a material selected from the group consisting of: Platinum (Pt), Platinum Rhodium (PtRh), Platinum Iridium (PtIr), and Tungsten Nitride (WNx, WN, or W_2N).

9. (Original) The capacitor of claim 1, wherein said bottom conducting layer is placed on top of an oxygen barrier.

10. (Original) The capacitor of claim 1, wherein said dielectric layer is a dielectric metal oxide layer.

11. (Original) The capacitor of claim 1, wherein said dielectric layer has a dielectric constant between 7 and 300.

12. (Original) The capacitor of claim 1, wherein said dielectric layer is formed of a material selected from the group consisting of: Tantalum Oxide, Tantalum Pentoxide (Ta_2O_5), Barium Strontium Titanate (BST), Aluminum Oxide (Al_2O_3), Zirconium Oxide (ZrO_2), Praseodymium Oxide (PrO_2), Tungsten Oxide (WO_3), Niobium Pentoxide (Nb_2O_5), Strontium Bismuth Tantalate (BST), Hafnium Oxide (HfO_2), Hafnium Silicate, Lanthanum Oxide (La_2O_3), Yttrium Oxide (Y_2O_3) and Zirconium Silicate.

13. (Original) The capacitor of claim 12, wherein said dielectric layer is formed of a material selected from the group consisting of: Tantalum Oxide, Tantalum Pentoxide (Ta_2O_5), Barium Strontium Titanate (BST), Strontium Bismuth Tantalate (SBT), Aluminum Oxide (Al_2O_3), Zirconium Oxide (ZrO_2) and Hafnium Oxide (HfO_2).

14. (Original) The capacitor of claim 13, wherein said dielectric layer is Tantalum Oxide and is amorphous or crystalline.

15. (Original) The capacitor of claim 1, wherein said top conducting layer is formed of a material selected from the noble metal group.

16. (Original) The capacitor of claim 1, wherein said top conducting layer is formed of a non-oxidizing metal permeable to oxygen.

17. (Original) The capacitor of claim 1, wherein said top conducting layer is formed of a conducting metal oxide.

18. (Original) The capacitor of claim 1, wherein said top conducting layer is formed of a material selected from die group consisting of: Platinum (Pt), Platinum Rhodium (PtRh), Platinum Iridium (PtIr), Ruthenium, Ruthenium Oxide (RuO_2), Rhodium Oxide (RhO_2), Chromium Oxide (CrO_2), Molybdenum Oxide (MoO_2), Rhemium Oxide (ReO_3), Iridium Oxide (IrO2), Titanium Oxides (TiO_1 or TiO_2), Vanadium Oxides (VO_1 or VO_2), and Niobium Oxides (NbO_1 or NbO_2).

19. (Original) The capacitor of claim 18, wherein said top conducting layer is formed of a material selected from the group consisting of: Platinum (Pt), Platinum Rhodium (PtRh), and Platinum Iridium (PtIr).

20. (Original) The capacitor of claim 1, wherein said bottom and top conducting layers are formed of a material selected from the group consisting of: Platinum, Platinum Rhodium (PtRh), or Platinum Iridium (PtIr) and said dielectric layer is a layer of Tantalum Oxide.

21. (Original) The capacitor of claim 1, wherein said bottom and top conducting layers are formed of a material selected from the group consisting of: Platinum, Platinum Rhodium (PtRh), or Platinum Iridium (PtIr) and said dielectric layer is a layer of Barium Strontium Titanate (BST).

22. (Original) The capacitor of claim 1, wherein said top conducting layer is formed of a material selected from the group consisting of: Platinum, Platinum

Rhodium (PtRh), or Platinum Iridium (PtIr) and said bottom conducting layer is a layer of Tungsten Nitride (WNx, WN, or W_2N) layer and said dielectric layer is a layer of Aluminum Oxide (Al_2O_3).

23. (Original) The capacitor of claim 1, wherein said top conducting layer is annealed with an oxygen compound.

24. (Original) The capacitor of claim 23, wherein said oxygen annealed layer is one annealed in the presence of a material selected from the group consisting of: Oxygen (O_2), Ozone (O_3), Nitrous Oxide (N_2O), Nitric Oxide (NO), and water vapor (H_2O).

25. (Original) The capacitor of claim 23, wherein said oxygen annealed layer is one annealed in the presence of a gas mixture containing at least one element selected from the group consisting: Oxygen (O_2), Ozone (O_3), Nitrous Oxide (N_2O), Nitric Oxide (NO), and water vapor (H_2O).

26. (Previously presented) The capacitor of claim 23, wherein said annealed top conducting layer is a plasma enhanced annealed top conducting layer.

27. (Previously presented) The capacitor of claim 23, wherein said annealed top conducting layer is a remote plasma enhanced annealed top conducting layer.

28. (Previously presented) The capacitor of claim 23, wherein said annealed top conducting layer is an ultraviolet light enhanced annealed top conducting layer.

29. (Original) The capacitor of claim 1, wherein said capacitor is a stacked capacitor.

30. (Original) The capacitor of claim 1, wherein further comprising an access transistor connected to said capacitor.

31. (Original) The capacitor of claim 1, wherein said capacitor forms part of a dynamic random access memory cell.

Claims 32-98 (canceled).

99. (Previously presented) A capacitor for a semiconductor device, said capacitor comprising:

a bottom electrode;

a dielectric layer formed over said bottom electrode; and

a top electrode comprising at least one conducting layer formed over said dielectric layer, wherein at least an uppermost portion of said conducting layer is an oxidized gas annealed layer.

REMARKS

Claims 1-31 and 99 are pending. Applicants respectfully request reconsideration of the above-referenced application in light of the following remarks.

Claims 1-31 and 99 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Narwankar et al. (U.S. Patent No.: 6,475,854 B2) ("'854 patent"). The rejection is respectfully traversed.

Applicants note that the prior art rejection of all the pending claims, *e.g.*, claims 1-31 and 99, is entirely predicated on the Narwankar reference. Narwankar issued as a patent on November 5, 2002. Narwankar first published on November 22, 2001 as U.S. 2002/0043453 A1. Narwankar's date of filing is December 21, 2000. Narwankar claims the benefit of provisional application no.: 60/173,928 ("'928 provisional application"), filed on December 30, 1999. Thus, the earliest effective date of the Narwankar reference is December 30, 1999.

Applicants respectfully submit, however, that the subject matter of claims 1-31 and 99, was not disclosed in Narwankar's '928 provisional application filed on December 30, 1999. Accordingly, the earliest effective date of the Narwankar reference in regards to the subject matter of claims 1-31 and 99, then becomes December 21, 2000. Since the instant application was filed on June 6, 2000, Narwankar is not prior art against the present application.

The Office Action states that in regards to claims 1, 23, and 99, Narwankar discloses a bottom conducting layer 605, a dielectric layer 606, a top conducting layer 608, and annealing the entire top conducting layer 608 comprising an oxygen permeable material, which results in an oxidized gas annealed top layer 610 (pgs. 2-3). In support of this assertion, the Office Action cites Narwankar's Table 1 and FIG. 6e.

Table 1 and FIG. 6e, however, were not in the '928 provisional application, filed on December 30, 1999. In fact, there is no disclosure in the '928 provisional application of any layers 605, 606, 608, or 610. Therefore, since Narwankar is not entitled to the '928 provisional application filing date for the subject matter on which to reject Applicants' claims, it is not prior art to the subject matter of claims 1-31 and 99, and all rejections based thereon should be withdrawn.

Further, the Office Action asserts that as to claim 4, Narwankar discloses "bottom layer 605 is formed from a noble metal/metal alloy such as Ru, Pt, Ru, TiN, Ta2O5," and cites Table 1 for support. As indicated above, Table 1 was not in the '928 provisional application. Accordingly, Narwankar is not prior art to the subject matter of claim 4.

The Office Action asserts that as to claims 5-8 and 17-28, Narwankar discloses "bottom conducting layer 605 is formed of a conducting metal oxide, metal nitride," and cites Table 1 for support. Table 1 was not in the '928 provisional application. Accordingly, Narwankar is not prior art to the subject matter of claims 5-8 and 17-28.

The Office Action asserts that as to claim 9, Narwankar discloses "the bottom layer is on top of the oxygen barrier 606," and cites FIG. 6e as support. FIG. 6e was also not in the '928 provisional application. Accordingly, Narwankar is not prior art to the subject matter of claim 9.

The Office Action asserts that as to claim 16, Narwankar discloses "the top conducting layer 615 may be formed of a non-oxidizing metal permeable to oxygen," and cites Table 1 for support. Table 1 was not in the '928 provisional application. Accordingly, Narwankar is not prior art to the subject matter of claim 16.

In addition, the Title of the Invention has been amended to be more descriptive of the pending claims. No new matter has been added. The Examiner's approval is respectfully solicited.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Dated: November 18, 2004

Respectfully submitted,

By _____

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